

BIPOLAR ENDOSCOPIC SURGICAL SCISSOR BLADES AND INSTRUMENT
INCORPORATING THE SAME

monta *21*
BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to endoscopic surgical instruments. More particularly, the invention relates to an endoscopic surgical instrument having end effectors made out of a combination of conductive and non-conductive materials. The invention has particular use with respect to bipolar endoscopic cautery. For purposes herein, the term "endoscopic instruments" is to be understood in its broadest sense to include laparoscopic, arthroscopic, and neurological instruments, as well as instruments which are inserted through an endoscope.

2. State of the Art

Endoscopic surgery is widely practiced throughout the world today and its acceptance is growing rapidly. In general, endoscopic/laparoscopic surgery involves one or more incisions made by trocars where trocar tubes are left in place so that endoscopic surgical tools may be inserted through the tubes. A camera, magnifying lens, or other optical instrument is often inserted through one trocar tube, while a cutter, dissector, or

other surgical instrument is inserted through the same or another trocar tube for purposes of manipulating and/or cutting the internal organ. Sometimes it is desirable to have several trocar tubes in place at once in order to receive several surgical instruments. In this manner, organ or tissue may be grasped with one surgical instrument, and simultaneously may be cut with another surgical instrument; all under view of the surgeon via the optical instrument in place in the trocar tube.

Various types of endoscopic surgical instruments are known in the art. These instruments generally comprise a slender tube containing a push rod which is axially movable within the tube by means of a handle or trigger-like actuating means. An end effector is provided at the distal end of the tube and is coupled to the push rod by means of a clevis so that axial movement of the push rod is translated to rotational or pivotal movement of the end effector. End effectors may take the form of scissors, grippers, cutting jaws, forceps, and the like. Because of their very small size and the requirements of strength and/or sharpness, end effectors are difficult to manufacture and are typically formed of forged stainless steel. As such, they form an expensive portion of the endoscopic instrument.

Modern endoscopic procedures often involve the use of electrocautery, as the control of bleeding by coagulation during

surgery is critical both in terms of limiting loss of blood and in permitting a clear viewing of the surgical site. As used herein, cautery, electrocautery, and coagulation are used interchangeably. Several types of electrocautery devices for use in endoscopic surgery are described in the prior art. Monopolar electrosurgical instruments employ the instrument as an electrode, with a large electrode plate beneath and in contact with the patient serving as the second electrode. High frequency voltage spikes are passed through the instrument to the electrode (i.e., end effector) of the endoscopic instrument to cause an arcing between the instrument and the proximate tissue of the patient. The current thereby generated continues through the patient to the large electrode plate beneath the patient. Monopolar cautery has the disadvantage that the current flows completely through the patient. Because control of the current path through the body is not possible, damage can occur to tissue both near and at some distance from the surgical site. In addition, it has been observed that monopolar cautery can result in excessive tissue damage due to the arcing between the end effector and the tissue.

In order to overcome the problems associated with monopolar cautery instruments, bipolar instruments have been introduced. In bipolar electrosurgical instruments, two electrodes which are closely spaced together are utilized to contact the tissue. Typically, one end effector acts as the first electrode, and the

other end effector acts as the second electrode, with the end effectors being electrically isolated from each other and each having a separate current path back through to the handle of the instrument. Thus, in a bipolar instrument, the current flow is from one end effector electrode, through the tissue to be cauterized, to the other end effector electrode.

Various endoscopic instruments with cautery capability are known in the art. U.S. Patent Number 4,418,692 to Guay, for example, discloses a device for use in laparoscopic tubal cauterization for blocking the Fallopian tubes of a patient. The device comprises a substantially tubular body member having a spring-biased piston slidably mounted therein. A pair of electrodes (either monopolar or bipolar) are disposed to grasp living tissue when the piston is in a first position biased by the spring and to release the tissue when a button is pressed which moves the piston into a second position. The device includes a circuit breaker which interrupts current flowing to the electrodes when the piston is in the second position. When the electrodes grasp the tissue, however, current is supplied to the entire surface of the electrode, that is, both the grasping surface and the outer non-grasping surface.

Another electrosurgical instrument for use in combination with an endoscope is disclosed in U.S. Patent Number 5,007,908 to

Rydell for "Electrosurgical Instrument Having Needle Cutting Electrode and Spot-Coag Electrode". Rydell's device includes an elongated flexible tubular member with a plurality of lumens. The distal end of the tubular member is provided with a bullet shaped ceramic tip covered with a conductive layer and having an opening coupled to a first one of the lumens. The conductive layer is coupled to a conductor which extends through a second one of the lumens to an electrical source. A second conductor, also coupled to the electrical source is slidable through the first lumen by a plunger. The two electrodes form a bipolar pair. In a second embodiment, the conductive layer on the ceramic tip is split by an insulating gap and both halves of the tip form a bipolar pair of electrodes. As with the Guay device, above, substantially the entire distal surface of Rydell's device serves as an electrode when energized.

Several hemostatic bipolar electrosurgical scissors have also been described. U.S. Patent #3,651,811 to Hildebrandt describes a bipolar electrosurgical scissors having opposing cutting blades forming active electrodes. The described scissors enables a surgeon to sequentially coagulate the blood vessels contained in the tissue and then to mechanically sever the tissue with the scissor blades. In particular, with the described bipolar electrosurgical scissors, the surgeon must first grasp the tissue with the scissor blades, energize the electrodes to cause

hemostasis, de-energize the electrodes, and then close the scissor blades to sever the tissue mechanically. The scissors are then repositioned for another cut accomplished in the same manner. With the bipolar electrosurgical scissors of Hildebrandt, the surgeon cannot maintain the electrodes in a continuously energized state because the power supply would be shorted out and/or the blades damaged if the blades are permitted to contact each other while energized.

The disadvantages of the bipolar scissors of Hildebrandt are overcome by the disclosure in U.S. Patent Nos. 5,324,289 and 5,330,471 to Eggers. In its preferred embodiment, the bipolar electrosurgical scissors of Eggers comprise a pair of metal scissor blades which are provided with an electrically insulating material interposed between the shearing surfaces of the blades so that when the scissor blades are closed, the metal of one blade never touches the metal of the other blade; i.e., the insulating material provides the cutting edge and the shearing surface. With the arrangement provided by Eggers, a cautery current will pass from the top back edge of the bottom metal blade through the tissue which is to be cut and to the bottom back edge of the top metal blade directly in advance of the cutting action. As the scissors are gradually closed, the hemostasis preferentially occurs at a location just in advance of the cutting point which itself moves distally along the insulated cutting edges of the

blades in order to sever the hemostatically heated tissue. With this arrangement, the scissors may be maintained in a continuously energized state while performing the cutting. The Eggers patent describes various alternative embodiments of the bipolar scissors, including the use of metal blades with only one blade being insulated on its shearing surface, and the use of insulating blades with back surfaces coated with metal.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a pair of scissor blades for a bipolar cauterizing surgical scissors which provide a metal on metal cutting/shearing action.

It is another object of the invention to provide a pair of scissor blades for a bipolar cauterizing surgical scissors which have shearing surfaces that are insulated from cautery surfaces.

It is also an object of the invention to provide an endoscopic bipolar cauterizing scissors which provides a metal on metal cutting action and which may be either curved or flat.

In accord with the objects of the invention, the scissor blades of the present invention are comprised of an electrically conductive electrode, an electrically insulating material, and a

metal shearing surface which is electrically insulated and physically spaced from the electrode by the insulating material which is disposed therebetween. The scissor blades, for example, may comprise but are not limited to a composite assembly of an electrode layer, an insulating layer, and a metal shearing surface layer. In the presently preferred embodiment, the electrode layer is a metal blade which is typically constructed from stainless steel, while the insulating layer is a ceramic which is deposited, bonded, or otherwise fixed on the metal blade, and the metal shearing surface layer which also provides the cutting edge is a metal (e.g., copper, gold, stainless steel etc.) which is metalized, deposited, sputtered, plated, bonded, or otherwise fixed onto the ceramic. In a second embodiment, the insulating layer is a ceramic support, with the electrode layer and the metal shearing surface layer being metalized, deposited, sputtered, plated, bonded, or otherwise fixed to the ceramic support. In a third embodiment, the insulating layer is deposited, bonded, or otherwise fixed onto a metal blade which includes the cutting edge and shearing surface, while the electrode metal layer is metalized, deposited, sputtered, plated, bonded, or otherwise fixed onto the insulating layer. In a fourth embodiment, the insulating layer is a composite material such as fiberglass which is provided with metal electrode and metal shearing surface layers which are metalized, deposited, sputtered, plated, bonded, or otherwise fixed onto opposite sides of the fiberglass layer. In

all embodiments, since the metal cutting edges and shearing surfaces are insulated from the electrodes, no short circuit can form between the electrodes even though the cutting edges and shearing surfaces are metal.

As the scissor blades are intended for use as part of an endoscopic instrument, each blade is preferably provided with a first hole which receives an axle or clevis pin around which the blades rotate. In addition, each blade is preferably provided with a pin or protrusion extending from a proximal or base portion of the blade. The pins are provided to receive links which couple the blades to an actuator mechanism.

The endoscopic bipolar cautery scissors instrument which utilizes the blades of the invention is substantially as is described in copending application U.S. Serial No. 08/284,793, the complete disclosure of which is hereby incorporated by reference herein, and utilizes a push rod assembly with two conductive push rods which are stabilized and insulated relative to each other. The distal ends of the push rods are coupled to the end effectors by the links. The proximal ends of the push rods extend through the handle and lever of the scissors instrument and present electrical cautery pins onto which a standard bipolar cautery plug can be mated.

Additional objects and advantages of the invention will become apparent to those skilled in the art upon reference to the detailed description taken in conjunction with the provided figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a broken side elevation view in partial section of an endoscopic bipolar scissors instrument according to the invention;

Figure 2 is a broken top view in partial section of the instrument of Figure 1;

Figure 3 is an enlarged broken side elevation view in partial section of the distal end of the instrument of Figure 1;

Figure 3a is an enlarged broken top view in partial section of the distal end of the instrument of Figure 1;

Figure 4 is a view similar to Figure 3a of a second embodiment of a distal push rod collar;

Figure 4a is a side elevation view of the collar of Figure 4;

Figure 4b is a distal end view of the collar of Figure 4a;

Figure 4c is a proximal end view of the collar of Figure 4a;

Figure 5 is an enlarged top view of a first embodiment of scissor blades according to the invention;

Figure 6 is a cross sectional view of the scissor blades of Figure 5 taken along lines 6-6 and shown in their operating positions;

Figure 7 is a view similar to Figure 6 but showing one of the scissor blades of Figures 5 and 6 in use with a conventional scissor blade in an alternative first embodiment;

Figure 8 is a view similar to Figure 5 of a second embodiment of the scissor blades according to the invention;

Figure 9 is a cross sectional view of the scissor blades of Figure 8 taken along lines 9-9 and shown in their operating positions;

Figure 10 is a view similar to Figures 5 and 8 of a third embodiment of the scissor blades according to the invention;

Figure 11 is a cross sectional view of the scissor blades of Figure 10 taken along lines 11-11 and shown in their operating positions;

Figure 12 is a view similar to Figures 5, 8, and 10 of a fourth embodiment of the scissor blades according to the invention; and

Figure 13 is a cross sectional view of the scissor blades of Figure 12 taken along lines 13-13 and shown in their operating positions.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to Figures 1 through 3a, an endoscopic bipolar scissors instrument 10 includes a proximal handle 12 with a manual lever actuator 14 pivotally coupled to the handle by a pivot pin 15. A hollow stainless steel tube 16 is rotatably coupled to the handle 12 and is preferably rotatable about its longitudinal axis relative to the handle 12 through the use of a ferrule 18 such as described in detail in previously incorporated copending application Serial Number 03/284,793. A push rod assembly 20 extends through the hollow tube 16 and is coupled at its proximal end 22 to the manual lever actuator 14 as described in more detail in copending application Serial Number 08/284,793. The distal end

of the tube 16 has an integral clevis 24 within which a pair of scissor blades 26, 28 are mounted on an axle screw 30. The distal end 23 of the push rod assembly 20 is coupled to the scissor blades 26, 28 so that reciprocal movement of the push rod assembly 20 relative to the tube 16 opens and closes the scissor blades 26, 28. It will be appreciated that the reciprocal movement of the push rod assembly 20 relative to the tube 16 is effected by movement of the manual lever actuator 14 relative to the handle 12.

The presently preferred embodiment of the push rod assembly 20 includes a pair of stainless steel rods 32, 34 which are molded into a proximal collar 36 and captured in a distal collar 46. The proximal collar has a radial groove 40 in its distal portion and an increased diameter proximal portion 37 which carries a pair of electrical coupling pins 39 which are electrically coupled to the rods 32, 34. As shown, the pins 39 are spaced farther apart from each other than the rods 32, 34 so as to accommodate a standard cautery connector. The rods 32, 34 are covered with insulating high density polyethylene (HDPE) tubes along substantially their entire length between the proximal and distal collars 36, 46. A plurality of spaced apart polypropylene cylinders 50 are molded about the rods between the proximal collar 36 and the distal collar 46. These cylinders stabilize the rods against helical

twisting when the tube 16 is rotated and, by being discontinuous, prevent against warping of the push rod assembly.

According to one embodiment, and as seen best in Figures 3 and 3a, the distal collar 46 is made from two ceramic pieces 46a, 46b which are snap fit and bonded to each other. A pair of clevis insulators 76 are placed in the clevis as shown in Figure 3a. Each clevis insulator 76 has a proximal side slot 76a and a distal bushing hole 76b. The collar 46 has a pair of guiding wings 47, 49 which engage slots 76a in the clevis insulators 76. The electrically conductive rods 32, 34 exit the distal collar 46 through opposite sides at substantially right angles. The distal ends of the rods 32, 34 are mechanically and electrically coupled to the respective blades 26, 28 by respective electrically conductive links 99.

According to a presently preferred embodiment, and as best seen in Figures 4, 4a, 4b, and 4c, a distal collar 146 is a single ceramic unit which is substantially circular in cross section except for upper and lower projections 147, 149. These projections engage the space between arms 24a, 24b of the clevis 24 and prevent the collar 146 from rotating in the clevis 24 and from passing beyond the proximal end 24c of the clevis 24. Consequently, the projections each have a pair of substantially parallel edges 147a, 147b, 149a, 149b and a rounded proximal edge

147c, 149c. The collar 146 has a pair of push rod receiving channels 150, 152 for receiving the push rods 32, 34 respectively. The channels have portions 150a, 152a which are radially open to the surface of the collar 146 from the proximal end thereof to a point approximately half way under the projections 147, 149. The channels 150, 152 terminate under the projections 147, 149 with a right angle bend 150b, 152b. A radial opening 150c, 152c extends proximally along each side of the collar from the right angle bend 150b, 152b to a point contiguous with the radially open part 150a, 152a of the channels 150, 152. The radial openings 150c, 152c are each substantially orthogonal to the radially open parts 150a, 152a. The distal end of the collar 146 has a pair of ramped slot openings 154, 156 which terminate at their proximal ends with substantially semi-circular grooves 158, 160. The slot openings and grooves are provided to accommodate the ends of links 99 (see Figures 1 and 3) for coupling the distal ends of the push rods 32, 34 to scissor blades. The collar 146 is easily attached to the distal ends of the push rods 32, 34 by pressing the push rods into the radially open parts 150a, 152a of the channels 150, 152 so that the bent ends of the push rods enter the radial openings 150c, 152c. The push rods and/or the collar 146 are pushed towards each other so that the bent ends of the push rods abut the right angle bends 150b, 152b in the channels 150, 152, at which location the links 99 are coupled to the push rods.

Referring now to a first embodiment of the scissor blade invention seen in Figures 5 and 6, the first scissor blade 26 has a distal portion 26a, a lower proximal tang 26c, and a mounting hole 26d therebetween. A connecting lug 26e extends orthogonally outward from the surface of the tang 26c in a first direction. As shown in Figures 5 and 6, the distal portion 26a includes an lower cutting edge 26b and an inner surface 26f (also called the shearing surface). Behind the inner surface 26f of the first scissor blade is an insulating layer 26r, and a conducting electrode layer 26q. The opposed second scissor blade 28 is configured similarly to the first scissor blade and has a distal portion 28a, an upper proximal tang 28c, and a mounting hole 28d therebetween. A connecting lug 28e extends orthogonally from the surface of the tang 28c in a second direction which is opposite to the first direction mentioned above. The distal portion 28a includes an upper cutting edge 28b and an inner surface 28f. Behind the inner surface 28f of the second scissor blade 28 is an insulating layer 28r, and a conducting electrode layer 28q.

According to the first embodiment shown in Figures 5 and 6, both scissor blade assemblies 26 and 28 are laminated assemblies which include a metal support (also called a metal blade support) 26q, 28q, an intermediate electrically insulative layer 26r, 28r and a metal blade or face 26f, 28f defining a shearing surface. It will be appreciated that the metal faces 26f, 28f are

preferably provided with sharpened opposed cutting edges 26b, 28b. The metal blade supports 26q, 28q form the electrically conductive portions (i.e., the electrodes) of the scissor blades through which cautery current is applied. In this regard, substantially the entire lengths of blade supports 26q, 28q are conductive, including the proximal lugs 26e which make electrical connection with the respective rods 32, 34 via links 99 as described above with reference to Figures 3-4c. As seen in Figure 6, the preferential path of current flow "E" is through the metal support portions 26q, 28q of the scissor blades which are insulated from the cutting edges 26b, 28b and the shearing surfaces (faces) 26f, 28f of the blades. Because of this arrangement, cautery and coagulation current may be applied continuously throughout the cutting/shearing procedure since the contact of the cutting edges and shearing surfaces of the blades will not short circuit the device.

The embodiment shown in Figure 5 and 6 may be manufactured by first laminating machined or cast stainless steel, superalloy, bronze or other conductive metal blade supports 26q, 28q with the insulating layers 26r, 28r such as by gluing, glazing, spraying, depositing, firing, or otherwise fixing a ceramic to the inner surfaces of blade supports 26q, 28q. The metal faces 26f, 28f having the cutting edges and shearing surfaces may then be applied by gluing, sputtering, metalizing, thermal spraying, plating, or

otherwise fixing the metal layers 26f, 28f onto the insulating layers 26r, 28r. The edges 26b, 28b may be sharpened after the laminating process is completed. The insulating layers may advantageously be made of an aluminum-oxide or another ceramic, and a nickel/aluminum coating may be advantageously applied to the blade supports to aid in bonding the aluminum-oxide ceramic insulating layers to the metallic blade supports.

From the foregoing, it will be appreciated that in order to achieve the object of preventing the cutting edges and shearing surface from short circuiting the device, it is only necessary that one of the scissor blades be constructed as described above. Figure 7 shows an alternative to the first embodiment of the invention where one of the blades 26 of the first embodiment is used in conjunction with a conventional scissor blade 128 which is entirely conductive. In this embodiment and in the embodiments described below, similar reference numerals refer to similar elements of the embodiments. As illustrated in Figure 7, the preferential path of current flow "E" is through the metal support portion 26q of blade 26 to the shearing surface 128f and/or cutting edge 128b of the scissor blade 128.

Figures 8 and 9 show a second embodiment of scissor blades 226, 228. According to this embodiment, both scissor blades 226 and 228 are laminated assemblies which include a blade support

226q', 228q', which itself is a laminated sub-assembly of a non-conductive core support 226r, 228r and an outer metallic layer support 226q, 228q. A metal blade layer or face 226f, 228f defining a shearing surface is laminated to the inner surface of the non-conductive core 226r, 228r. It will be appreciated that the metal blade layers 226f, 228f are preferably provided with sharpened opposed cutting edges 226b, 228b. The outer metallic layers 226q, 228q of the blade supports 226q', 228q' form the electrode portions of the blades through which cautery current is applied. As seen best in Figure 8, the outer metallic layers 226q, 228q extend along substantially the entire length of the blades (over the non-conductive cores 226r, 228r) to make an electrical connection with a source of cautery at the proximal connecting lugs 226e, 228e of the blades. As seen in Figure 9, the path of preferential current flow "E" is through the electrode portions 226q', 228q' of the blades which are insulated from the cutting edges and the shearing surfaces of the blades. Because of this arrangement, cautery current may be applied continuously throughout the cutting procedure since the contact of the shearing surfaces of the blades will not short circuit the device.

The embodiment shown in Figures 8 and 9 may be manufactured by molding ceramic cores 226r, 228r and laminating both the inner and outer surfaces with metal by gluing, sputtering, metalizing, thermal spraying, plating, etc. the metal layers onto the ceramic

cores. In this case, the ceramic material should preferably be formed with a flange type cross section as denoted by 226r', 228r' so that the inner and outer metal laminates do not contact each other. According to the presently preferred embodiment, the outer layers may be formed from a metal such as copper, gold, stainless steel, superalloy, or other conducting material. Preferably, the inner surface layer including the cutting edges 226b, 228b are formed from a metal which can be sharpened after the laminating process is completed. The ceramic cores 226r, 228r may be made of aluminum-oxide ceramic and nickel/aluminum coated to aid in bonding with the inner and outer metal laminates.

It will be appreciated that either of the blades 226, 228 from Figures 8 and 9 may be used with an opposed blade 28, 26 from Figures 5 and 6, or with a conventional blade 128 from Figure 7 as explained above with reference to Figure 7.

Figures 10 and 11 show a third embodiment of scissor blades 326, 328. According to this embodiment, both scissor blades 326 and 328 are formed from metallic blades 326f, 328f which include the cutting edges 326b, 328b and shearing faces, and which are coated with a thin non-conductive layer 326r, 328r on their outer surface by gluing, glazing, spraying, depositing, firing, or otherwise fixing the non-conductive layer to the outer surfaces of the blade supports 326f, 328f. An outer metallic conductive layer

or support 326q, 328q is then applied to the non-conductive layer 326r, 328r by gluing, sputtering, metalizing, thermal spraying, plating, or otherwise. The outer metallic layers 326q, 328q form the electrically conductive portions of the blades through which cautery current is applied. As seen in Figure 10, both the insulating coating 326r, 328r and the outer metallic coating 326q, 328q extend along substantially the entire length of the blades so that electrical connection to a source of cautery current may be made at the connecting lug 326e, 328e of the blade to the outer metallic coatings 326q, 328q only. As seen in Figure 11, the path of preferential current flow "E" is through the electrode portions 326q, 328q of the blades which are insulated from the cutting edges and the shearing surfaces of the blades. One advantage of this third embodiment is that the cutting edges 326b, 328b of the scissor blades 326, 328 are part of standard type blades 326f, 328f which are coated. Thus, the feel of the endoscopic bipolar cautery instrument should be substantially the same as the feel of non-cautery endoscopic scissors.

Again, it should be noted that either of the blades 326, 328 of the third embodiment may be utilized with an opposed blade 28, 26, 228, or 226 from Figures 5, 6, 8, and 9, or with a conventional blade 128 from Figure 7 as explained above with reference to Figure 7. It will also be appreciated that although the blades shown herein are relatively flat, curved scissor blades

such as those shown in the copending application Serial No. 08/284,793 may be used instead.

A fourth embodiment of scissor blades 426, 428 is shown in Figures 12 and 13. The first scissor blade 426 has a curved distal portion 426a, a lower proximal tang 426c, and a mounting hole 426d therebetween. A connecting lug 426e extends orthogonally outward from the surface of the tang 426c in a first direction. As shown in Figures 12 and 13, the distal portion 426a includes a lower cutting edge 426b and an inner or shearing surface 426f. Behind the inner surface 426f of the first scissor blade is an insulating layer 426r, and a conducting electrode layer 426q. The opposed second scissor blade 428 is configured similarly to the first scissor blade and has a curved distal portion 428a, an upper proximal tang 428c, and a mounting hole 428d therebetween. A connecting lug 428e extends orthogonally from the surface of the tang 428c in a second direction which is opposite to the first direction mentioned above. The distal portion 428a includes an upper cutting edge 428b and an inner surface 428f. Behind the inner surface 428f of the second scissor blade 428 is an insulating layer 428r, and a conducting electrode layer 428q.

According to this fourth embodiment, both blades 426 and 428 are laminated assemblies having a non-conductive core 426r, 428r.

The core 426r, 428r is preferably formed from a fiberglass or a similar material and includes the curved distal portion 426a, 428a, the proximal tang 426c, 428c, and the mounting hole 426d, 428d. A metal blade layer 426f, 428f defining a shearing surface is laminated to the inner surface of the non-conductive core 426r, 428r along the curved distal portion 426a, 428a. It will be appreciated that the metal blade layers 426f, 428f are preferably provided with sharpened opposing cutting edges 426b, 428b. An outer metallic support layer 426g, 428g is laminated to the outer surface of the non-conductive core 426r, 428r from the mounting hole 426d, 428d along the curved distal portion 426a, 428a. The outer metallic support layers 426g, 428g form the electrically conductive portions of the blades through which cautery current is applied. Thus, the outer metallic support layer 426g, 428g extends along substantially the entire length of the core 426r, 428r to make an electrical connection at the lug 426e, 428e as described above with reference to Figures 3-4c. As seen in Figure 14, the path of preferential current flow "E" is through portions 426g, 428g of the blades which are insulated from the cutting edges and the shearing surfaces of the blades. It should be noted that the laminated blades of the fourth embodiment can be made more flexible than the blades of the other embodiments. It should also be noted that the laminated blades of the fourth embodiment could be provided as straight blades. Further, it will be appreciated that a straight or curved blade of the fourth

embodiment can be used with any of the blades of the first, second, or third embodiments, or with a conventional blade such as shown in Fig. 7.

There have been described and illustrated herein several embodiments of bipolar endoscopic surgical scissor blades and an instrument incorporating them. While particular embodiments of the invention have been described, it is not intended that the invention be limited thereto, as it is intended that the invention be as broad in scope as the art will allow and that the specification be read likewise. Thus, while particular conductive and non-conductive materials have been disclosed, it will be appreciated that other materials could be utilized. Also, while blades of specific shape and dimension have been shown, it will be recognized that blades having different shapes and dimensions could be used with similar results obtained. While means for pivotally joining the blades has been shown as an axle screw with a nut, other pivotal joining means could be used. For example, a clevis with an integral axle pin, or a snap-in axle pin, or a riveted axle pin could all be used. While means for supplying each blade with a voltage has been shown as a bipolar push rod, it will be appreciated that other means such as a bipolar clevis and bipolar hollow tube could be used. Individual shielded electrical conductors within the hollow tube could also be used for this purpose. In addition, while the electrical coupling of the

conductive portion of each blade has been shown as the proximal connecting lug which connects to a link, it will be appreciated that an electrical coupling could be made through a two piece bipolar clevis axle. Also, while the means for imparting scissor-like movement to the blades has been shown as a push rod, a pull wire or other reciprocating arrangement might be used as well. In addition, while the means for coupling the scissor blades to the push rod has been shown as an orthogonal lug, it will be understood that other means such as a connecting hole could be used while achieving substantially the same results. Moreover, while particular methods have been disclosed in reference to laminating conductive and non-conductive layers, it will be appreciated that other methods could be used as well.